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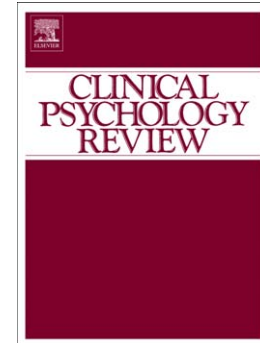
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**A Systematic Review of the Use of Acceptance and Commitment Therapy (ACT) in
Chronic Disease and Long-Term Conditions**

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Abstract

Many have proposed that Acceptance and Commitment Therapy (ACT) may be particularly effective for improving outcomes in chronic disease/long-term conditions, and ACT techniques are now being used clinically. However, reviews of ACT in this context are lacking, and the state of evidence is unclear. This systematic review aimed to: collate all ACT interventions with chronic disease/long-term conditions, evaluate their quality, and comment on efficacy. Ovid MEDLINE, EMBASE and Psych Info were searched. Studies with solely mental health or chronic pain populations were excluded. Study quality was then rated, with a proportion re-rated by a second researcher. Eighteen studies were included: eight were randomised controlled trials (RCTs), four used pre-post designs, and six were case studies. A broad range of applications were observed (e.g. improving quality of life and symptom control, reducing distress) across many diseases/conditions (e.g. HIV, cancer, epilepsy). However, study quality was generally low, and many interventions were of low intensity. The small number of RCTs per application and lower study quality emphasise that ACT is not yet a well-established intervention for chronic disease/long-term conditions. However, there was some promising data supporting certain applications: parenting of children with long-term conditions, seizure-control in epilepsy, psychological flexibility, and possibly disease self-management.

Key words: Acceptance and Commitment Therapy; systematic review; chronic disease; cancer; HIV; long-term conditions.

Chronic diseases/long-term conditions such as diabetes, HIV, cancer or brain injury (henceforth long-term conditions) have a detrimental impact on well-being, as indicated by reduced quality of life (QoL) and mood (Barrios et al., 2015; Do et al., 2014; Graham, Rose, Grunfeld, Kyle, & Weinman, 2011; Jopson & Moss-Morris, 2003; Miners et al.; Renn, Feliciano, & Segal, 2011). Nonetheless, a large variation in QoL and mood across people with the same condition or with the same level of disease severity/disability level is often apparent (Graham, Rose, Hankins, Chalder, & Weinman, 2013; Miglioretti, Mazzini, Oggioni, Testa, & Monaco, 2008), and even those with the most severe symptoms may have preserved QoL and mood (Lule, Hacker, Ludolph, Birbaumer, & Kubler, 2008; Robbins, Simmons, Bremer, Walsh, & Fischer, 2001). It therefore follows that factors other than the disease process, or its direct functional limitations, may help explain well-being in these conditions. Indeed, a large body of research shows that psychological factors are particularly important in this context. They explain significant proportions of the variation in QoL and mood, even after controlling for disease severity or disability level. Influential variables include, but are not limited to, illness perceptions, coping strategies, self-efficacy, psychological flexibility, and emotion regulation (de Ridder, Geenen, Kuijer, & van Middendorp, 2008; Dennison, Moss-Morris, & Chalder, 2009; Graham, Weinman, et al., 2014; Moss-Morris, 2013; Pakenham & Fleming, 2011; Petrie & Weinman, 2012).

Cognitive behavioural models, such as the well-known Self-Regulation Model (Leventhal, Nerenz, & Steele, 1984), posit that the explanatory value of psychological variables is derived from their influence on disease self-management behaviour, and the regulation of the distress caused by the context of a given condition. Any condition is likely to involve a range of adaptive self-management behaviours, such as adhering to medications, attending appointments with health professionals or amending one's activities and diet. A second parallel process of psychological adjustment may also occur, involving evaluation of the functional impact of the condition (for

example on social and occupational functioning) and the regulation of any resultant distress (Leventhal et al., 1984).

The empirical support for the importance of psychological processes in long-term conditions has led to the development and application of cognitive behavioural interventions which target these processes to improve a range of outcomes, from QoL and mood to treatment adherence and disease self-management (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002; Graham, Simmons, Stuart, & Rose, 2015; Petrie & Weinman, 2012). Consequently, clinical psychologists and healthcare professionals in related disciplines now play a key role in the treatment of people with long-term conditions.

Traditional Cognitive Behavioural Therapy in long-term conditions

Mirroring its popularity in mental health conditions (Butler, Chapman, Forman, & Beck, 2006), interventions derived from traditional Cognitive Behavioural Therapy (traditional CBT) have been widely applied to improve distress and self-management in long-term conditions (Beatty & Lambert, 2013; Greer et al., 1992; Hind et al., 2014; Ismail, Winkley, & Rabe-Hesketh, 2004; Petrie, Perry, Broadbent, & Weinman, 2012). These see one's beliefs as the central process in therapy (Beck, 1976; Halford & Brown, 2009), a target supported by the large number of studies showing that aberrant beliefs about illness or medication predict many salient outcomes (e.g. QoL, treatment adherence, mood etc.; Petrie & Weinman, 2012). Consequently, traditional CBT comprises techniques such as verbal modification or behavioural experiments to enable participants to change dysfunctional beliefs about illness, the self, the future, or medication, as a means to reduce distress, instigate better self-management or improve quality of life (Halford & Brown, 2009). Traditional CBT shows promising utility in the context of long-term conditions, with strongest evidence for distress-reduction in cancer, where a small to medium effect size has been shown (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012).

Acceptance and Commitment Therapy in long-term conditions

Acceptance and Commitment Therapy (ACT) is a newer form of cognitive behavioural therapy (Hayes, Luoma, Bond, Masuda, & Lillis, 2006), which has evolved from experimental work regarding the influence of language on behaviour (Zettle, 2005) and is, in part, informed by Relational Frame Theory (De Houwer, Barnes-Holmes, & Barnes-Holmes, 2016). While a full description of this theory is beyond the scope of this review, the main implication for treatment is that language processing is viewed from within the paradigm of behaviourism. Thus, one can understand how ‘thinking’ affects overt behaviour, in this case ineffective patterns of behaviour that maintain suffering, without the need to focus on the *content* of the thoughts.

Although there is some overlap between the two interventions, the aforementioned theoretical assumptions dictate that ACT targets different change processes from traditional CBT. First, instead of attempting to change beliefs (for example, trying to replace “negative” or “maladaptive” thoughts with more “adaptive thoughts”), ACT targets the process of thinking, or to be more exact, aims to reduce the behavioural and functional influence of thinking. It thus seeks to foster a general process called psychological flexibility, which is defined as being open, aware and in contact with the present moment, and flexibly engaging in behaviours which facilitate overarching life goals (Bond, Hayes, & Barnes-Holmes, 2006). Psychological flexibility is a broad concept and to facilitate its clinical application, it can be broken down into six sub-processes: experiential acceptance, contact with the present moment, defusion, self-as-context, values, and committed action (described in Table 1).

Second, unlike traditional CBT, ACT sees many forms of distress as a natural consequence of being human; the experience of suffering, self-doubt, fear, uncertainty, self-criticism, negative thinking, dysphoria etc. are normal human experiences. ACT does not explicitly aim to reduce distress (although this can occur as a side-effect of greater psychological flexibility, or of increased meaningful activity), but rather to increase one’s ability to undertake meaningful activity in the

presence of distress. ACT uses a range of methods to engender psychological flexibility: for example, mindfulness exercises to enable one to be present-moment-focused, defusion exercises to change one's relationship with thoughts, and values elicitation exercises to orientate participants to activities which are in line with personally meaningful values (McCracken, 2011). Examples of these techniques as applied in the context of long-term conditions are listed in Table 1.

Why might ACT have utility in long-term conditions?

Many have expressed the opinion that ACT has utility over existing psychotherapeutic models in the context of long-term conditions (Angiola & Bowen, 2013; Graham et al., 2015; Hadlandsmyth, White, Nesin, & Greco, 2013; Low et al., 2012; Whittingham, 2014). For example, negative illness beliefs and distress may be realistic in certain conditions at certain times. Thus, ACT's focus on instigating valued behaviours while accepting such thoughts and feelings may prove more effective than attempts to directly alter them (as in traditional CBT) (Graham et al., 2015; Low et al., 2012). Others have suggested that non-adherence to HIV medication (Moitra, Herbert, & Forman, 2011) or poor diabetes self-management (Hadlandsmyth et al., 2013) are related to avoidance of disease-related thoughts and feelings, such as fear or shame. Therefore, ACT's focus on encouraging (experiential) acceptance in the service of meaningful behaviour may be particularly efficacious for disease self-management or treatment adherence (see Table 1). This strong face validity of ACT in the context of long-term conditions appears to be translating into clinical practice – there is emerging evidence that ACT techniques are being widely adopted by health professionals working with long-term conditions (Thewes et al., 2014).

Efficacy of ACT in other contexts

The empirical status of ACT for chronic pain (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011) and mental health populations (A-Tjak et al., 2015; Öst, 2008, 2014; Swain, Hancock, Hainsworth, & Bowman, 2013; Zum & Emmelkamp, 2009) has been previously reported. A-Tjak et al. (2015) noted that ACT has been trialled in a diverse group of conditions (psychosis, OCD, anxiety

disorders). In their meta-analysis of primary outcomes in 39 studies, a medium effect size in favour of ACT was observed when compared with psychological placebo or treatment as usual – a similar effect size to traditional CBT. In two further general meta-analyses, Öst (2008, 2014) observed a small overall effect on primary outcomes of similar magnitude to traditional CBT approaches. Öst (2014) noted an exponential rate of growth in the number of ACT intervention studies in the period between these meta-analyses, but critiqued the continued poor methodological quality of much of this research. Similarly, a meta-analytic review of ACT in chronic pain, which included ten randomised controlled trials, observed a small-to-medium effect on physical and mental health when compared to treatment as usual, again with similar effects to traditional CBT (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011).

Therefore, to date, the evidence collated from intervention studies across mental health conditions and chronic pain populations implies: 1) a rapidly growing number of intervention studies; 2) a small to medium overall effect on outcomes; 3) caveats of low methodological quality, and similar levels of efficacy to traditional CBT. It is unclear if this pattern is also apparent in long-term conditions – a context that has been advanced as particularly amenable to ACT intervention (e.g., Hadlandsmyth et al., 2013; Whittingham, 2014).

The Present Review

Psychological processes and interventions: a transdiagnostic perspective

Medical intervention (e.g. medication, surgery etc.) requires diagnoses defined by biological pathology, since such treatments target processes at this level. In contrast, psychological intervention targets a transdiagnostic upstream group of cognitive and behavioural processes that are arguably common across long-term conditions. Supporting this, a critical review by de Ridder et al., (2008) advanced several components of successful psychological adjustment to long-term conditions, which apply across diagnoses; for example, disease self-management, successful performance of adaptive tasks, protection of occupational functioning, and emotion regulation.

Such a conceptualisation is commensurate with ACT, a transdiagnostic approach (Clarke, Kingston, James, Bolderston, & Remington, 2014; Lang et al., 2012), that sees intervention targets as functionally (as opposed to topographically) defined. For instance, a person with diabetes may avoid feelings of guilt and shame and avoid thoughts of failing to self-manage by not testing their blood glucose regularly. While person with HIV may avoid feelings of fear and thoughts regarding self-identity by missing hospital visits. These two self-management behaviours are different in form, but functionally equivalent. They are maintained because they enable experiential avoidance (see Table 1).

Therefore, in this review, instead of collating results based primarily upon the long-term condition in which the study was undertaken, we focused on the purpose of the intervention (its primary/secondary outcomes). Aside from its aforementioned ecological validity, this approach has another benefit: if assumptions regarding shared context and psychological process are accepted, then results from this review may be generalised to long-term conditions which are rarer, where rigorous intervention studies are unfeasible, but where evidence-based psychological interventions are still very much required.

Aims

While some of the aforementioned systematic reviews/meta-analyses have included a very small number of studies with long-term conditions (A-Tjak et al., 2015; Gundy, Woidneck, Pratt, Christian, & Twohig, 2011; Öst, 2008, 2014), a comprehensive review of ACT as applied to long-term conditions is lacking. Given the evidence of ACT's existing clinical usage in this context (Thewes et al., 2014), calls for further application (Angiola & Bowen, 2013; Graham et al., 2015; Hadlandsmyth et al., 2013; Low et al., 2012; Whittingham, 2014), and the rapid rate of growth in ACT intervention studies (Öst, 2014), we present a timely review of ACT for long-term conditions. The aim was to collate all ACT applications to accurately characterise the field, using a transdiagnostic approach, i.e., based on investigators' choice of outcome measures/treatment

targets, as opposed to the long-term condition (diagnosis) in question. Case studies were included, since they give clinically-useful descriptive accounts and allow further insight into the range of applications. It has been suggested that the general quality of ACT intervention studies is low (Hofmann & Asmundson, 2008; Öst, 2008, 2014), and that ACT has limited additional value over traditional methods (Hofmann & Asmundson, 2008). Therefore, we sought to evaluate the quality of studies which use trial methodology, comment on the emerging efficacy of ACT applications, and suggest ways to improve the quality of future intervention studies.

Method

Procedures

The procedures were informed by accepted systematic reviewing guidelines (Khan, Ter Riet, Glanville, Sowden, & Kleijnen, 2001; Moher, Liberati, Tetzlaff, Altman, & The, 2009). Ovid MEDLINE, EMBASE and Psych Info were searched from their earliest available listing to 22nd February 2015. Due to the large number of possible long-term conditions, a broad search strategy was applied. This used the key terms ACCEPTANCE AND COMMITMENT THERAPY and CONTEXTUAL COGNITIVE BEHAVIOUR. Abstracts were examined if the title suggested an intervention study with long-term conditions. To identify further relevant studies: 1) the reference sections of the included studies were examined; 2) Google Scholar was then used to search amongst articles which had cited the included studies.

Studies were included if they described an ACT intervention applied to a long-term condition. They were excluded if they: 1) were not published in English; 2) described a hypothetical intervention; 3) did not clearly use ACT techniques; 4) were undertaken with a chronic pain population (since this is well-reviewed elsewhere [McCracken & Eccleston, 2003; Veehof et al., 2011]) or mental health population (including insomnia and conversion disorders, 'functional' illness etc.); 5) were designed to prevent illness in a group without a long-term condition (see

Figure 1); or 6) were used to manage symptoms where evidence for causative biological pathology is unclear (e.g., irritable bowel syndrome, chronic fatigue syndrome/myalgic encephalopathy).

Study quality was then assessed using the Psychotherapy Outcome Study Methodology Rating Form (POMRF; Öst, 2008). This 22-item measure comprises various indicators of methodological quality, for example: length of follow-up assessment, composition of comparison interventions, reliability and specificity of measures, and therapist training. Items are rated as 'Poor' (0 points), 'Fair' (1 point) or 'Good' (2 points), giving a maximum score of 44 points. Two items (Items 2 & 4) which were related to certainty of psychiatric diagnoses were removed. Therefore, in the present study, the maximum possible score was 40.

The quality of all studies was assessed by the lead author (CDG). To improve the accuracy/validity of this assessment, a sub-section (5 papers) were randomly selected (random number generator) and also rated by another researcher (CK). A moderate level of inter-rater agreement between reviewers was observed ($k = 0.60$, $p < .001$) (Altman, 1991). Discrepancies were discussed and reconciled; then all articles were rated again by the lead author.

Data extraction plan

Data regarding the sample characteristics, composition of the intervention and control intervention, outcome measures and indicators of efficacy (proportion of statistically significant outcomes and effect size [Cohen's d]) were extracted. Where possible, the effect sizes reported within the publication were used. Where these were not available, effect sizes were calculated by comparison of the post-intervention means of the experimental and control group (between-groups), or comparison between pre- and post-intervention means (within-groups).

Results

The initial database search returned 1436 studies, from which 23 publications were retrieved in full. The removal of study protocols and interventions with insomnia populations left 15 remaining studies. Five additional studies were obtained from Google Scholar. However, upon

closer inspection, a study which showed low fidelity to ACT and another with a healthy population, were removed. Thus, 18 studies were included in the systematic review (Figure 1).

Description of the included studies

Of these 18 studies, six were case studies (or case series) (Gillanders & Gillanders, 2014; Graham, Gillanders, Stuart, & Gouick, 2014; Masuda, Cohen, Wicksell, Kemani, & Johnson, 2011; Moitra et al., 2011; Nes et al., 2012; Skinta, Lezama, Wells, & Dilley, 2014); four used pre-post designs with no control group (Burke et al., 2014; Feros, Lane, Ciarrochi, & Blackledge, 2013; Goodwin, Forman, Herbert, Butryn, & Ledley, 2011; Sheppard, Forsyth, Hickling, & Bianchi, 2010); and eight were randomised controlled trials (RCT) (Brown, Whittingham, Boyd, McKinlay, & Sofronoff, 2014; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Hawkes, Pakenham, Chambers, Patrao, & Courneya, 2014; Hawkes et al., 2013; Lundgren, Dahl, Melin, & Kies, 2006; Lundgren, Dahl, Yardi, & Melin, 2008; Nordin & Rorsman, 2012; Rost, Wilson, Buchanan, Hildebrandt, & Mutch, 2012; Whittingham, Sanders, McKinlay, & Boyd, 2014). The studies using RCT and pre-post designs involved samples of people with cancer (Feros et al., 2013; Hawkes et al., 2013, 2014; Rost et al., 2012); epilepsy (Lundgren et al., 2006; Lundgren et al., 2008); multiple sclerosis (Nordin & Rorsman, 2012; Sheppard et al., 2010); cardiac disease (Goodwin et al., 2011); type II diabetes (Gregg et al., 2007); paediatric cerebral palsy (Whittingham et al., 2014); brain injury (Brown et al., 2014); and “life threatening illness” (Burke et al., 2014). The case studies demonstrate applications to distress and trauma in multiple sclerosis (Gillanders & Gillanders, 2014); distress following stroke (Graham, Gillanders, Stuart, & Gouick, 2014); systemic processes to improve functioning with sickle cell disease (Masuda et al., 2011); improving adherence (Moitra et al., 2011) and reducing stigma in HIV (Skinta et al., 2014); and improving self-management in diabetes (Nes et al., 2012).

The RCT studies compared ACT to a waitlist control group (Whittingham et al., 2014), treatment as usual (TAU) (Brown et al., 2014; Hawkes et al., 2013, 2014), and other active

treatments (including education, yoga, cognitive therapy, relaxation training, supportive therapy) (Gregg et al., 2007; Lundgren et al., 2006; Lundgren et al., 2008; Nordin & Rorsman, 2012; Rost et al., 2012; Whittingham et al., 2014). In studies using group-based analyses, one study had a sample size of 205 (Hawkes et al., 2013, 2014); however, most others had a small sample size ($M = 22.09$, $SD = 12.57$; range = 10 – 45) (Table 2).

Most (nine) of the included interventions were delivered at least in part within groups (Brown et al., 2014; Burke et al., 2014; Goodwin et al., 2011; Gregg et al., 2007; Lundgren et al., 2006; Lundgren et al., 2008; Nordin & Rorsman, 2012; Sheppard et al., 2010; Whittingham et al., 2014), with just three (Feros et al., 2013; Hawkes et al., 2013, 2014; Rost et al., 2012) delivered exclusively via one-to-one sessions with a therapist. The number of sessions ranged from 1-12. Most interventions were brief ($M = 6.5$ sessions, $SD = 4.06$), with seven studies evaluating interventions of no more than five sessions (Burke et al., 2014; Goodwin et al., 2011; Gregg et al., 2007; Lundgren et al., 2006; Lundgren et al., 2008; Nordin & Rorsman, 2012; Sheppard et al., 2010). An average of 81% ($SD = 14.99$; range 60 -100) of participants completed treatment, indicating low participant drop-out. Three interventions showed 100% completion (Gregg et al., 2007; Lundgren et al., 2006; Lundgren et al., 2008; Table 2.). No included case study used an experimental design, one recorded reliable change (Gillanders & Gillanders, 2014), and one used session-by-session measurement of outcomes (Graham et al., 2014).

Quality of studies using group-based statistics

Study quality was generally low ($M = 19.33$, $SD = 5.40$; range = 10-30) with just six of the 11 (Brown et al., 2014; Gregg et al., 2007; Hawkes et al., 2013, 2014; Lundgren et al., 2006; Lundgren et al., 2008; Whittingham et al., 2014) studies receiving more than half of the available points on the POMRF. We used this cut-off (>20 points on the POMRF) to denote a higher-quality study. The highest quality study (Hawkes et al., 2013, 2014) achieved a score of 30 (Table 2).

Several consistent strengths were apparent across studies. All studies presented a fair description of statistical methods and results, with all but one (Nordin & Rorsman, 2012) achieving a maximum score. All studies gave at least a fair description of the intervention and/or were able to direct readers to an intervention manual, with six of 11 (Brown et al., 2014; Gregg et al., 2007; Lundgren et al., 2006; Lundgren et al., 2008; Nordin & Rorsman, 2012; Whittingham, 2014) achieving a maximum score. All studies used outcomes measures that were psychometrically adequate (specific and/or reliable), and all included a population which appeared representative of a clinical sample.

Nonetheless, only one study used evaluators who were blinded to the treatment condition (Hawkes et al., 2013, 2014). Also, just one (Lundgren et al., 2006) showed a clear effort to control for concomitant treatments. Studies often introduced a systematic condition/therapist confound by having one therapist per condition or did not report the number of therapists (Burke et al., 2014; Feros et al., 2013; Lundgren et al., 2008; Rost et al., 2012). Just three studies (Gregg et al., 2007; A. Hawkes et al., 2013, 2014; Whittingham et al., 2014) included an *a priori* power calculation, while consideration of clinical significance was apparent in just four studies (Feros et al., 2013; Gregg et al., 2007; Hawkes et al., 2013, 2014; Whittingham et al., 2014). Control interventions were often unequal in duration to the ACT intervention (4 of 6 RCTs) (Brown et al., 2014; Gregg et al., 2007; Hawkes et al., 2013, 2014; Whittingham et al., 2014). Long-term (i.e., 12-month) follow-up was evident in just three studies (Hawkes et al., 2013, 2014; Lundgren et al., 2006; Lundgren et al., 2008). Bearing in mind the general low study-quality, we next turn to evaluating of the emerging efficacy for ACT in the main/consistent outcome measures.

Applications and their emerging efficacy

The ACT interventions sought to engender change in a range of outcomes. An analysis of the emerging efficacy for ACT for the main outcome is described below.

Distress

Six studies evaluated whether ACT interventions reduced distress in people with long-term conditions (Burke et al., 2014; Feros et al., 2013; Hawkes et al., 2013, 2014; Nordin & Rorsman, 2012; Rost et al., 2012; Sheppard et al., 2010). With one exception (Nordin & Rorsman, 2012), all observed a significant improvement in most measures of distress following ACT. Where reported, this change most frequently showed a large effect size (range $d = 0.75 - 1.86$) (Burke et al., 2014; Feros et al., 2013; Rost et al., 2012).

Three of these studies used RCT designs (Hawkes et al., 2013, 2014; Nordin & Rorsman, 2012; Rost et al., 2012). The highest quality study compared a telephone-delivered ACT intervention for people with colorectal cancer to TAU (Hawkes et al., 2013, 2014). Here, no significantly greater improvement was observed in the ACT group compared to TAU at post-intervention ($d = -0.01$) or follow-up. However, participants were not pre-selected on the basis of marked distress, making it less likely that a post-intervention improvement in this outcome might be detected. Two lower-quality studies, more explicitly targeting distress, compared ACT to active treatments - relaxation training (Nordin & Rorsman, 2012) and cognitive therapy (Rost et al., 2012). Rost et al. (2012) evaluated a 12-session ACT treatment, delivered in a one-to-one format, for women with late-stage ovarian cancer. A significantly greater reduction occurred in all measures of distress following ACT. When compared to cognitive therapy, a very large average effect size was observed ($d = 1.28$). Nordin and Rorsman (2012) evaluated a brief group-delivered ACT intervention for distress in multiple sclerosis. There was no significant benefit of ACT over relaxation training post-intervention or at follow-up. However, this trial appeared underpowered, with just 11 participants in the ACT condition.

Two case studies detailed ACT applied to distress in neurological illnesses (Gillanders & Gillanders, 2014; Graham et al., 2014). Gillanders and Gillanders (2014) describe an intervention involving an individual with multiple sclerosis and her husband. Sessions aimed to enhance

adjustment to multiple sclerosis against a background of childhood trauma. The case study showed clinically significant improvements in psychological flexibility and distress. Graham et al. (2014) outline the application of an ACT intervention to post-stroke anxiety, describing how acceptance, workability analysis and present-moment-awareness can be used to manage illness-related fears. Subsequent improvements in stress and post-stroke anxiety were noted in this study.

In summary, with one exception (Nordin & Rorsman, 2012), ACT interventions were consistently associated with post-intervention improvements in distress. However, bar one highly-supportive but lower-quality study (Rost et al., 2012), it is unclear whether ACT is superior to TAU or other psychological interventions, or whether the consistent post-intervention improvements observed are not the result of regression to the mean, placebo or non-specific therapeutic factors.

Parenting of children with long-term conditions

Two higher-quality studies evaluated ACT for improving parenting and subsequent emotional and behavioural problems of children with brain injury (Brown et al., 2014) and cerebral palsy (Whittingham et al., 2014), respectively. Both studies included an ACT-enhanced version of an established parenting program, Stepping Stones Triple P (Sanders, 2012), and had similar sample sizes ($N = 30$; Brown et al., 2014) and ($N = 23$; Whittingham et al., 2014). Following the intervention, both observed a moderate ($d = 0.61 - d = 0.77$) improvement in parenting. One (Brown et al., 2014) noted a large and statistically significant ($d = 0.84$) subsequent improvement in child behavioural and emotional problems, while the other observed a small change ($d = 0.25$) in this outcome.

When compared to waitlist control or TAU, both observed significant improvements of moderate-to-large effect size in dysfunctional parenting styles post-intervention ($d = 0.65 - 0.82$). Most measures showed statistically significant improvements. However, while a subsequent impact on child behavioural and emotional problems in favour of ACT was evident in these comparisons, they showed smaller effect sizes ($d = 0.48 - 0.67$).

Whittingham et al. (2014) included a further trial arm: comparing the ACT enhanced Stepping Stones Triple P intervention to the Stepping Stones Triple P intervention alone. Here, just one of eight ($d = 0.04$) child behavioural and emotional problems variables showed greater response to ACT, with one showing a significantly greater response to Stepping Stones Triple P alone. No post-intervention between-group differences in dysfunctional parenting were apparent, but at six-month follow-up the ACT group had significantly better outcomes on two of three measures. However, the ACT-embedded intervention was four hours longer than the Stepping Stones Triple P alone.

Masuda et al. (2011) present a case study of a family-based ACT intervention for improving functioning in a teenager with sickle cell disease. A range of ACT techniques were applied: perspective-taking, experiential acceptance, and values-clarification in relation to parenting. Post-intervention improvements were noted in child- and parent-reported outcomes at the end of the intervention, with further improvement to three-month follow-up.

In sum, two higher-quality studies supported the application of ACT to improving the parenting of children with long-term conditions. ACT showed effects which were greater than TAU for improving dysfunctional parenting and child behavioural and emotional problems. Further, results from one high-quality study (Whittingham et al., 2014) suggest that incorporating ACT into an established parenting intervention may increase its efficacy. However, a caveat is that the ACT-embedded intervention was longer in duration than the established parenting intervention alone.

Self-management/lifestyle

Three studies evaluated ACT for improving disease self-management and/or lifestyle (Goodwin et al., 2011; Gregg et al., 2007; Hawkes et al., 2013, 2014). In a lower-quality study, Goodwin et al. (2012) evaluated a brief group-based ACT intervention for improving lifestyle in people with cardiac diseases. This pre-post design observed significant and large improvements in all aspects of self-reported diet (3 of 3 measures significant; $d = 1.27$) and small, less consistent

improvements in weight (1 of 2 measures significant; $d = .11$). Yet, there was no significant improvement in self-reported exercise (0 of 1 measures significant); a moderate effect size was observed for this comparison ($d = 0.54$).

In a higher-quality study, Hawkes et al. (2013, 2014) assessed a more intensive intervention (individualised, with more sessions) for improving lifestyle in colorectal cancer survivors. Here significant improvements were seen in self-reported weight (1 of 1 measure significant) and most aspects of diet (4 of 6 measures significant). Compared to a TAU condition (in which educational materials regarding methods to reduce cancer risk were made available), significant improvements were observed in self-reported weight and diet, and these were mostly maintained at 12-month follow-up. This study had a very large sample size ($N = 205$) and while most comparisons were statistically significant, these changes showed small effect sizes ($d = 0.20 - 0.23$). No improvements in self-rated physical activity over TAU were apparent at post-intervention (0 of 3 measures significant, $d = 0.06$); but by 12 month follow-up the ACT group were significantly more active (2 of 3 measures significant).

In another high-quality study, Gregg et al. (2007) evaluated an ACT-based diabetes self-management workshop. Compared to a diabetes education group, they observed a significant improvement of moderate size in self-management ($d = 0.68$) and a significantly greater proportion of participants in objectively measured glucose control ($d = 0.61$). Yet, no significant difference between groups in mean HbA1c blood levels was apparent ($d = 0.35$).

One case series outlined a smartphone-based intervention for improving self-management in diabetes (Nes et al., 2012). The smartphones included diaries with written situational feedback, alongside face-to-face and telephone consultation with clinicians.

To summarise, there is some emerging evidence that ACT can improve disease self-management and lifestyle. One higher-quality study showed support when compared to TAU, though the size of this effect appeared very small (Hawkes et al., 2013, 2014) and many outcomes

were self-reported questionnaires, as opposed to direct behavioural measures (e.g., pedometers). Another higher-quality study observed a significant comparative improvement of moderate size in biochemical measures of disease self-management (Gregg et al., 2007). Thus, at present, a small number of studies suggest that ACT may be effective in these contexts. However, given that so few comparisons could be made (one comparison with TAU; one comparison with an active treatment) this evidence is very preliminary.

Quality of life (QoL)

Six studies used QoL as an outcome measure (Feros et al., 2013; Hawkes et al., 2013, 2014; Lundgren et al., 2006; Lundgren et al., 2008; Rost et al., 2012; Sheppard et al., 2010). Most showed significant improvements in QoL following ACT (Feros et al., 2013; Hawkes et al., 2013, 2014; Lundgren et al., 2008; Rost et al., 2012); with moderate-to-large effect sizes ($d = 0.56$ to $d = 1.59$) (Feros et al., 2013; Lundgren et al., 2006; Lundgren et al., 2008; Rost et al., 2012). Though one, trial of a very brief (one session) intervention, found only a modest impact on this outcome ($d = 0.24$) (Sheppard et al., 2010).

One higher-quality study compared ACT to TAU for improving lifestyle and QoL in colorectal cancer survivors (Hawkes et al., 2013, 2014). Here, no significant improvements over TAU were observed in QoL domains (Hawkes et al., 2013, 2014), with a corresponding small average effect size ($d = 0.08$).

Three studies compared ACT to active treatments (Lundgren et al., 2006; Lundgren et al., 2008; Rost et al., 2012). Two were higher-quality – albeit underpowered – studies investigating the efficacy of ACT for improving seizure control and QoL in epilepsy (Lundgren et al., 2006; Lundgren et al., 2008). When compared to supportive therapy, a small non-significant improvement in QoL was observed at post-intervention ($d = 0.37$, 95% CI -0.40, 1.13) (Lundgren et al., 2006), which became significant at 12-month follow-up (Lundgren et al., 2006). However, when compared to yoga, a small effect size in favour of yoga was observed ($d = -0.38$) (Lundgren et al., 2008). One

lower-quality study investigated the impact of individualised ACT on distress and QoL in women with late-stage ovarian cancer (Rost et al., 2012). When compared to an intervention of the same intensity which was reminiscent of cognitive therapy (involving cognitive restructuring and relaxation training), an average large ($d = 1.28$) significantly greater improvement in QoL was apparent in the ACT group.

Thus, together the existing evidence presents an inconsistent picture of the efficacy of ACT for improving QoL in long-term conditions. While a consistent post-intervention improvement in QoL was apparent, it is unclear whether ACT interventions are more effective than TAU or other active treatments, or again if post-intervention improvements are the result of placebo effect, regression to the mean or non-specific therapy factors.

Psychological flexibility

Six studies assessed post-ACT intervention changes in psychological flexibility, as measured with the Acceptance and Avoidance Questionnaires (Burke et al., 2014; Feros et al., 2013; Goodwin et al., 2011; Gregg et al., 2007; Hawkes et al., 2013, 2014; Nordin & Rorsman, 2012). All observed significant pre-to-post intervention improvements following ACT in at least half of included measures of psychological flexibility. Where it was reported or could be calculated (Burke et al., 2014; Feros et al., 2013; Goodwin et al., 2011; Gregg et al., 2007), this change showed a small-to-moderate effect size ($d = 0.57-0.72$).

One study compared changes in psychological flexibility to TAU. This higher-quality trial of ACT for people with colorectal cancer observed a comparatively greater improvement in psychological flexibility in the experimental group (Hawkes et al., 2013, 2014). However, this difference had a very small effect size ($d = 0.15$) and it was not maintained at 12-month follow-up.

Two studies which compared an ACT intervention to active treatments returned divergent results. In a higher-quality study, Gregg et al. (2007) evaluated an ACT self-management workshop for diabetes self-regulation, compared to an educational diabetes self-management

workshop alone. Post-intervention changes in psychological flexibility were greater in the ACT group, with a moderate effect size ($d = 0.78$). A lower-quality evaluation of an ACT intervention for people with multiple sclerosis observed no significant improvement compared to relaxation training, since both interventions showed significant improvement by post-intervention (Nordin & Rorsman, 2012).

In summary, improvements in psychological flexibility following ACT were evident across studies. In one higher-quality study this was greater than TAU, albeit with a small effect size (Hawkes et al., 2013, 2014). Another observed greater improvement following ACT when compared to education (Gregg et al., 2007); however, a lower-quality study found no evidence of a greater benefit from ACT when compared to relaxation training (Nordin & Rorsman, 2012). Thus, studies are few, the evidence to date suggests that psychological flexibility improvement following ACT may be greater than for treatment as usual and there is no evidence to suggest that it is significantly less effective than active treatments.

Direct symptom control

Two higher-quality studies evaluated the efficacy of ACT for directly controlling symptoms (Lundgren et al., 2006; Lundgren et al., 2008). Both included the same ACT intervention, which included sessions teaching behavioural methods for improving seizure control (Lundgren et al., 2006; Lundgren et al., 2008). These observed significantly greater improvements in seizure severity following ACT when compared to supportive therapy (Lundgren et al., 2006) or yoga (Lundgren et al., 2008), with large effect sizes observed for these comparisons ($d = 1.4-1.45$). However, both studies were underpowered and conducted by the same research group; thus, although the evidence supporting ACT for seizure control is promising, replications by other groups are required.

Treatment Adherence

Two case series examined adherence. These used a smartphone-delivered intervention to prompt self-management behaviours (including medication adherence) in diabetes (Nes et al., 2012)

and the use of acceptance, values and committed action exercises to improve adherence to HIV medication (Moitra et al., 2011). Both interventions were judged as acceptable by participants and post-intervention trends towards improvements in HIV biomarkers, HBA1C, and fasting blood glucose were observed. These case examples observed encouraging improvements in adherence. Therefore, larger-scale evaluations of ACT for improving adherence are warranted.

Stigma

One case study described an ACT-based group for reducing HIV- related self-stigma (Skinta et al., 2014). This emphasised the defusion, self-as-context, and values aspects of ACT. Some participants showed an improvement in self-stigma across sessions. This further application demonstrates the versatility of the ACT model. However, the design enabled no comment on emerging efficacy.

Discussion

A summary of the use of ACT in long-term conditions

ACT has been applied across many long-term conditions, for example: cancer (Feros et al., 2013; Hawkes et al., 2013, 2014; Rost et al., 2012), epilepsy (Lundgren et al., 2006; Lundgren et al., 2008), paediatric illness (Brown et al., 2014; Burke et al., 2014; Whittingham et al., 2014), cardiac disease (Goodwin et al., 2011), multiple sclerosis (Nordin & Rorsman, 2012; Sheppard et al., 2010), and diabetes (Gregg et al., 2007). It has been used to elicit change in a range of outcomes, from improving lifestyle/disease self-management (Gregg et al., 2007; Hawkes et al., 2013, 2014), and symptom control (Lundgren et al., 2006; Lundgren et al., 2008) to reducing distress (Nordin & Rorsman, 2012; Rost et al., 2012; Sheppard et al., 2010) and improving QoL (Feros et al., 2013; Lundgren et al., 2006; Lundgren et al., 2008). Several case studies describe the process of applying ACT, including: family intervention for functional impairment in an adolescent with sickle cell disease (Masuda et al., 2011); a smart-phone hosted diabetes self-management

intervention (Nes et al., 2012); and interventions for self-stigma (Skinta et al., 2014) and non-adherence in HIV (Moitra et al., 2011).

The range of long-term conditions and applications demonstrates the flexibility of the ACT model and also reflects the extent to which practitioners (Thewes et al., 2014) and clinical researchers (Angiola & Bowen, 2013; Graham et al., 2015; Hadlandsmyth et al., 2013; Moitra et al., 2011) working with long-term conditions have embraced ACT. Indeed, in agreement with other studies (Ost, 2014), the rate of ACT intervention studies appears to be increasing, with almost half the included studies published in 2014 (the year preceding the systematic search). It is arguable as to whether the wide-spread adoption of ACT is recognition that it is particularly applicable to long-term conditions, or is a therapeutic fad. However, this research is young – the first included study was published in 2006 (Lundgren et al., 2006). Thus, time is needed before this can be established.

It has been advanced that ACT might be usefully applied to medication non-adherence (Hadlandsmyth et al., 2013; Moitra et al., 2011). However, despite promising findings in case studies (Moitra et al., 2011; Nes et al., 2012), no comprehensive trials of this were evident in the present review. This is a missed opportunity since non-adherence to medication is a major public health problem, with an estimated 30-50% of medication not taken as recommended (Horne et al., 2005) and non-adherence being a behaviour(s) with a range of cognitive-behavioural correlates (Daley, Myint, Gray, & Deane, 2012; Horne & Weinman, 1999; Petrie et al., 2012; Petrie & Weinman, 2012). Therefore, ACT may be applicable (Graham et al., 2012).

State of the evidence

It is a consistent finding that ACT is associated with improved outcomes across applications within long-term conditions. However, the paucity of studies using RCT designs (per application) and the general low quality of studies meant it was unclear whether this was due to the intervention, non-specific therapy factors, placebo effects, or regression to the mean. Further, most included studies had small sample sizes. This is problematic because a negative correlation between sample

size and effect sizes exists (Slavin & Smith, 2009). Critics believe this to be due to an interaction between the large variability of results in underpowered studies and a publication bias, meaning that only those with statistically significant results and thus very large effect sizes (given the small sample size) are published. Such a phenomenon may have skewed the results of the present review.

Thus, an overall comment on this emerging field of ACT applications is that, whilst findings to date are encouraging for some applications, more high-quality research is needed before any application could be considered to have comprehensive empirical support (for example criteria, see (Chambless & Hollon, 1998; Öst, 2008, 2014). Nonetheless, there is emerging evidence that ACT may be effective in some contexts; with some supportive higher-quality studies and little counter-evidence, ACT shows promising application for improving the parenting of children with long-term conditions, seizure control in epilepsy, psychological flexibility, and possibly self-management/lifestyle.

A further consideration regarding efficacy is that the included interventions tended to have a very low number of sessions. A contemporaneous review of ACT interventions applied to anxiety (Swain, Hancock, Hainsworth, & Bowman, 2013) found that just 17% of ACT interventions were of five sessions or fewer compared to 58% in the present review, with many included interventions delivered by phone or in groups. Since a dose-effect relationship has been noted in psychotherapy, with those receiving more sessions having better final outcomes (Kopta, 2003), one might expect a smaller impact of ACT within the current context than in mental health. Thus, researchers should consider whether they are providing ACT interventions which are of sub-optimal intensity, given that long-term conditions are disabling/life-threatening and can be accompanied by mood disturbance.

Methodological suggestions

The low quality of evidence regarding efficacy is in contrast to the apparent clinical adoption of ACT for long-term conditions (Hadlandsmay et al., 2013; Moitra et al., 2011; Thewes et al.,

2014). This highlights the need for higher quality trials of ACT in this context. Below is a list of ways to improve methodology/reporting based on current limitations.

1. Trained blinded evaluators should collect outcome variables at each stage of the trial.
2. Interventions should include at least two therapists per treatment; this is required to disentangle the effects of the intervention from the clinician delivering the intervention.
3. A priori power calculations are required: several studies appeared underpowered and it was unclear to what extent.
4. Concomitant treatments should be recorded.
5. Active control interventions should be clearly described and matched for length, intensity, components and clinician allegiance.
6. Long-term follow-up is required (at least 12 months).
7. To comment on impact, a priori indicators of clinical significance should also be used, and economic analysis considered.
8. When behaviours are outcome variables, direct measurement should be used (for example, pedometers to record physical activity, and biochemical measures of adherence) (Miller & Hays, 2000; Tudor-Locke & Myers, 2001).
9. Finally, to aid calculation of effect sizes, means and standard deviations (or standard errors) for pre- and post-intervention measurements should be supplied. Further, to allow accurate calculation of within-group changes, correlation co-efficients between pre- and post-intervention variables could be provided as supplementary information (Lakens, 2013).

The design of ACT case study research could also be improved. Session-by-session measurement of outcomes and reliable change in outcomes were rarely reported. While case studies are arguably most useful as detailed descriptive accounts of the process of applying interventions, this does not mean that evaluation of change in outcomes is unimportant. Single case experimental designs can be used (Smith, 2012), and tools are available to assess the statistical significance of

changes across the period of intervention, as well as mediation via cross-lagged correlation (Borckardt et al., 2008). Indeed, in rare contexts or applications, the highest level of evidence may be derived from such research.

Limitations

Several limitations are implicit in the present review. First, owing to the existence of few RCTs per application, a detailed meta-analysis was omitted. However, given the rapid increase in intervention studies with long-term conditions, this may soon be recommended.

To enable more simple quantification and communication of the quality of studies in relation to their findings, a dichotomous cut-off for classifying studies as higher-quality and lower-quality was used. We would thus encourage readers to also reflect on individual quality ratings of each study (Table 2) in conjunction with the findings of the review. Also, some items of the POMRF are of limited applicability to long-term conditions. Here, two items regarding the certainty of diagnosis appeared superfluous and no assessment of whether outcomes were self-report or directly measured was included. Composition of specific quality assessment criteria for psychological intervention studies with long-term conditions is recommended.

Where effect sizes were not reported, we calculated effect size based on comparison between post-intervention scores. The accuracy of the resultant effect size relies on the unlikely assumption that pre-intervention scores were equivalent. Also, when calculating within-group effect sizes the correlation between the pre- and post- intervention variables was not included; thus, these effect sizes may be inaccurate (Lakens, 2013).

We collated studies by their primary/secondary outcomes, as opposed to the long-term condition in which they were conducted. While we took a pragmatic approach to this and collated studies by the primary/secondary outcomes designated by the respective researchers, it could be argued that grouping in other ways may be equally or more informative (e.g. stage of illness; whether disease modifying treatment is available or not; whether the condition is progressive or

cyclical in nature etc.). Finally, although pain is a frequent symptom of long-term conditions (Clifford & Trotter, 1984; Jensen et al., 2008) we did not include interventions for chronic pain, since these are well reviewed elsewhere (Veehof et al., 2011).

Conclusion

ACT has been applied in many different ways within a range of long-term conditions. However, there have been no trials of ACT for improving medication non-adherence. Most of the included studies were low quality and there were very few RCTs. Therefore, ACT interventions are not yet well established for use in long-term conditions. Nonetheless, there was some promising evidence that ACT may improve the parenting of children with long-term conditions, seizure-control in epilepsy, psychological flexibility and possibly disease self-management/lifestyle.

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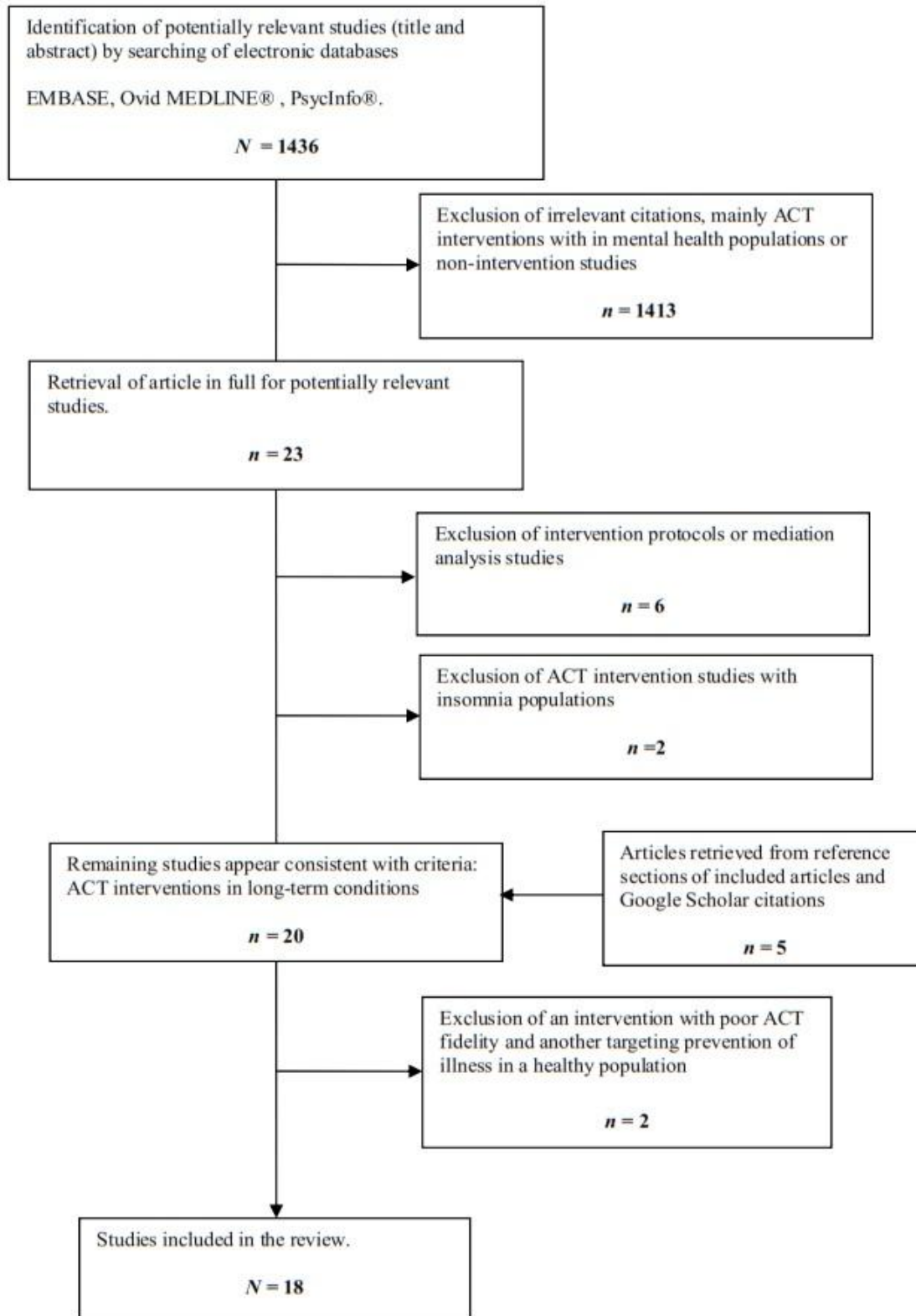


Figure 1. Flowchart showing the process of selecting studies to include in the review.

Table 1. Example of ACT intervention techniques which may be used in the context of long-term conditions

Psychological Flexibility facet	Example clinical focus	Example techniques
Experiential acceptance Opening-up to difficult/unpleasant thoughts and feelings when doing so serves one's values	Poor disease self-management	<u>Introduction</u> “Notice how when you don’t monitor your blood sugar, it protects you from feelings of failure (in case your blood sugar levels are not in the zone)...but in the longer term, what is it costing you?” <u>Experiential tasks</u> Workability exercises: helping a person notice that attempts to control or get rid of difficult thoughts and feelings are often counterproductive; encouraging openness to unpleasant thoughts and feelings by slowing down and attending to them (Harris, 2009; Wilson & Dufrene, 2009).
Contact with the present moment Noticing and attending to the here-and-now	Struggling with worries and fears about disease progression	<u>Introduction</u> “What happens when you find you are struggling with the fear that your muscle disorder is progressing? Do you find that you lose track of where you are, who you are with, what you are doing?” <u>Experiential tasks</u> Using aspects of mindfulness practice to help the person notice the here-and-now without needing to control or change it (Burch & Penman, 2013; Dahl & Lundgren, 2009; Harris, 2009; Hayes, Strosahl & Wilson, 2012).
Defusion Seeing thoughts as ongoing events, separable from the person doing the thinking	Reluctance to use mobility aides	<u>Introduction</u> “‘What type of thoughts does your mind give you when you consider using your wheelchair...? Instead of struggling with these thoughts or buying into them, what would happen if you chose to let these thoughts pass while you focus on doing what’s important to you ...would you be more likely to use your wheelchair?” <u>Experiential tasks</u> Teaching unhooking exercises: saying “thank you, mind” or “I am having the thought that” when they notice that they are struggling with thoughts and feelings (Harris, 2009; McCracken, 2011).

<p>Self-as-context</p> <p>Taking an observer perspective which is separate from thoughts or thinking and the ideas we have about who we are</p>	<p>Adjustment to a long-term condition and challenges to identity</p>	<p><u>Introduction</u></p> <p>“You said that ‘you have to be the strong one’, and that having MS makes that difficult. What would happen if you let go of that label? Would you do anything differently?”</p> <p><u>Experiential tasks</u></p> <p>Encouraging the person to “notice who is doing the noticing” during mindfulness practice (i.e. noticing that there is an observer part of us that exists outside of labels); asking them to write down experiences from different times in their life to help them notice that this observer part watched all of these experiences, and is independent of labels, including the label of their long-term condition (Dahl & Lundgren, 2006; Hayes, Strosahl & Wilson, 2012).</p>
<p>Values</p> <p>Knowing what’s personally meaningful</p>	<p>Non-adherence to medication, physiotherapy etc.</p>	<p><u>Introduction</u></p> <p>“You have mentioned that you really love spending time with your grandchildren...can adhering to your treatment regimen help you do more of this?”</p> <p><u>Experiential tasks</u></p> <p>Ask the person to write down what matters to them in different areas of their life (e.g. work, relationships), then indicate how consistently their actions are in line with their values; ask them to visualise their 100th birthday party –what would they want people to say about them (Dahl & Lundgren, 2006; Hayes, Strosahl & Wilson, 2012).</p>
<p>Committed action</p> <p>Taking actions which are consistent with personally meaningful values</p>	<p>Maintaining meaningful functioning even with illness</p>	<p><u>Introduction</u></p> <p>“I know that your condition is asking a lot of you, but what is the smallest possible step you can take to ensure that you are making progress on your values?”</p> <p><u>Experiential tasks</u></p> <p>Smallest possible step homework: Ask the person to focus on consistently choosing to make small actions which support their values over the prospective week; exploration of process of commitment as more important than the outcome (Harris, 2009; Hayes, Strosahl & Wilson, 2012).</p>

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Table 2. Summary of interventions, comparison groups and outcomes of included studies using pre- post- or RCT designs

Study	Design	POMR F Score (range 0 -40)	Disease Group	Primary Target of intervention	Format of intervention	No. of sessions (Total Hours)	N (% finished)	Control	Outcomes (Measures)	Improvement post-intervention (Mean ES)	Improvement compared to control (Mean ES)	Maintained at follow-up
Brown et al., (2014)	RCT	24	Paediatric brain injury	Parenting intervention	Group & individual	11 (17.5)	30 (85%)	TAU (access to rehab. Services)	Child behaviour & emotional problems (distress) (ECBI; SDQ)	(<i>d</i> = 0.84)	3/3 significant (<i>d</i> = 0.67)	2/3 maintained
									Dysfunctional parenting style (PS)	(<i>d</i> = 0.61)	2/2 significant (<i>d</i> = 0.65)	2/2 maintained
Burke et al., (2014)	Pre-post	10	Paediatric life threatening illness	Parental distress	Group therapy	5 (7.5)	11 (73%)	-	Parental distress (PCL-C; PEGI)	5/5 significant (<i>d</i> = 1.12)	-	5/5 maintained
									Psychological flexibility (PPF)	2/3 significant (<i>d</i> = 0.72)	-	3/3 maintained
									Mindfulness (MAAS)	1/1 significant (<i>d</i> = 0.54)	-	1/1 maintained
Feros et al., (2013)	Pre-post	15	Cancer	QoL and distress	Individual therapy	9 (6.75)	45 (62%)	-	Distress (DT; DASS)	2/2 significant (<i>d</i> = 1.05)	-	2/2 maintained
									QoL (FACT)	1/1 significant (<i>d</i> = 0.56)	-	1/1 maintained
									Psychological flexibility (AAQ II)	1/1 significant (<i>d</i> = 0.64)	-	1/1 maintained
Goodwin et al., (2011)	Pre-post	15	Cardiac disease	Improving lifestyle	Group therapy	4 (6)	16 (75%)	-	Self-report diet (ASA-24)	3/3 significant (<i>d</i> = 1.27)	-	-
									Weight (BMI; lbs)	1/2 significant (<i>d</i> = 0.11)	-	-
									Self-report exercise (IPAQ)	0/1 significant (<i>d</i> = 0.54)	-	-
									Mindfulness (PHLMS)	1/2 significant (<i>d</i> = 0.31)	-	-
									Defusion (DDS)	0/1 significant (<i>d</i> = 0.23)	-	-
									Values (VGCM)	1/1 significant (<i>d</i> = 0.33)	-	-
									Psych. flexibility (FAAQ; PA-AAQ)	1/2 significant (<i>d</i> = 0.57)		

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Study	Design	POMR F Score (range 0 -40)	Disease Group	Primary Target of intervention	Format of intervention	No. of sessions (Total Hours)	N (% finished)	Control	Outcomes (Measures)	Improvement post- intervention (Mean ES)	Improvement compared to control (Mean ES)	Maintained at follow- up
Gregg et al., (2007)	RCT	21	Type II Diabetes	Improving diabetes self-management	Group therapy	1 (4)	43 (100%)	Education (7hr workshop)	No. in glucose control	1/1 significant -	1/1 significant (<i>d</i> = 0.61)	-
									HbA1c	1/1 significant (<i>d</i> = 0.42)	0/1 significant (<i>d</i> = 0.35)	-
									Self-management (DSCAM)	1/1 significant (<i>d</i> = 1.06)	1/1 significant (<i>d</i> = 0.68)	-
									Psychological flexibility (AADQ)	1/1 significant (<i>d</i> = 0.49)	1/1 significant (<i>d</i> = 0.78)	-
									Understanding (DCP)	1/1 significant (<i>d</i> = 0.37)	0/1 significant (<i>d</i> = 0.30)	-
Hawkes et al. (2013; 2014)*	RCT	30	Colorectal cancer	Improving lifestyle	Individual therapy	11 (?)	205 (72%)	TAU (access to educational materials)	Self-report physical activity (GLTEQ;)	- (<i>d</i> = 0.14)	0/3 significant (<i>d</i> = 0.06)	2/3 better than control at follow-up
									Self-report weight (BMI)	1/1 significant (<i>d</i> = 0.37)	1/1 significant (<i>d</i> = 0.23)	1/1 maintained
									Self-report diet (CCVFFQ)	4/6 significant -	3/6 significant (<i>d</i> = 0.20)	2/6 maintained
									Distress (BSI-18)	1/1 significant -	0/1 significant (<i>d</i> = 0.01)	0/1 maintained
									QoL (SF-36; FACT-C)	3/3 significant -	0/3 significant (<i>d</i> = 0.08)	0/3 maintained
									Psychological flexibility (AAQ II)	1/1 significant -	1/1 significant (<i>d</i> = 0.15)	0/1 maintained
									Mindfulness (MAAS)	1/1 significant -	0/1 significant (<i>d</i> = -0.01)	0/1 maintained

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Study	Design	POMR F Score (range 0 -40)	Disease Group	Primary Target of intervention	Format of intervention	No. of sessions (Total Hours)	N (% finished)	Control	Outcomes (Measures)	Improvement post- intervention (Mean ES)	Improvement compared to control (Mean ES)	Maintained at follow- up
Lundgren et al., (2006)	RCT	22	Epilepsy	Improve seizure control & QoL	Group & individual	4 (11)	14 (100%)	Supportive therapy (11 hrs)	Seizure intensity (SI)	(<i>d</i> = 1.21)	1/1 significant (<i>d</i> = 1.45)	1/1 maintained
									QoL (WHOQOL- BREF)	(<i>d</i> = 0.62)	0/1 significant (<i>d</i> = 0.37)	1/1 improved to follow-up
									Life satisfaction (SWLS)	(<i>d</i> = 0.73)	1/1 significant (<i>d</i> = 1.72)	1/1 maintained
Lundgren et al., (2008)	RCT	21	Epilepsy	Improve seizure control & QoL	Group & individual	4 (12)	10 (100%)	Yoga (12hrs)	Seizure intensity (SI)	1/1 significant (<i>d</i> = 1.3)	1/1 significant (<i>d</i> = 1.14)	-
									QoL (WHOQOL- BREF)	1/1 significant (<i>d</i> = 0.81)	0/1 in favour of yoga (<i>d</i> = -0.38)	1/1 remained non- significant
									Life satisfaction (SWLS)	0/1 significant (<i>d</i> = 0.55)	0/1 significant (<i>d</i> = 0.12)	1/1 remained non- significant
Nordin & Rorsman (2012)	RCT	20	Multiple sclerosis	Treatment of distress	Group therapy	5 (?)	11 (?)	Relaxation training	Distress (HADS; BDI)	1/3 significant	0/3 significant	Remained non- significant
									Psychological flexibility (AAQ)	1/1 significant	0/1 significant	1/1 remained non- significant

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Study	Design	POMR F Score (range 0 -40)	Disease Group	Primary Target of intervention	Format of intervention	No. of sessions (Total Hours)	N (% finished)	Control	Outcomes (Measures)	Improvement post- intervention (Mean ES)	Improvement compared to control (Mean ES)	Maintained at follow- up
Rost et al., (2011)	RCT	17	Late-stage ovarian cancer	Treatment of distress	Individual therapy	12 (12)	25 (60%)	Cognitive therapy (12hrs)	QoL (FACT)	1/1 significant (<i>d</i> = 1.59)	1/1 significant (<i>d</i> = 1.35)	-
									Distress (POMS; BAI; BDI II)	3/3 significant (<i>d</i> = 1.87)	3/3 significant (<i>d</i> = 1.28)	-
									Acceptance coping (COPE)	1/1 significant (<i>d</i> = 1.58)	1/1 significant (<i>d</i> = 2.02)	-
									Mental disengagement (COPE)	1/1 significant (<i>d</i> = 1.83)	1/1 significant (<i>d</i> = 3.49)	-
									Emotional control (CECS)	1/1 significant (<i>d</i> = 3.76)	1/1 significant (<i>d</i> = 6.11)	-
									Thought suppression (WBSI)	1/1 significant (<i>d</i> = 1.97)	1/1 significant (<i>d</i> = 3.02)	-
Sheppard et al., (2010)	Pre- post	14	Multiple Sclerosis	QoL and distress	Group	1 (5)	15 (73%)	-	Distress (BDI – II)	1/1 significant (<i>d</i> = 0.75)	-	-
									QoL (SF-36 PCS; SF-36 MCS; QOLI)	1/3 significant (<i>d</i> = 0.24)	-	-
									Thought suppression (WBSI)	1/1 significant (<i>d</i> = 0.34)	-	-
									Mindfulness (MAAS)	0/1 significant (<i>d</i> = 0.23)	-	-
Whittingham et al., (2014)	RCT	23	Paediatric cerebral palsy	Parenting intervention	Group & individual	11 (17.5)	23 (91%)	1. WL control 2. Parenting interventi on (13.5hrs)	Child behaviour & emotional problems (ECBI; SDQ)	(<i>d</i> = 0.25)	1.3/8 significant (<i>d</i> = 0.48) 2. 1/8 significant + 1 in favour of SSTP (<i>d</i> = 0.14)	2. 1/8 maintained
									Dysfunctional parenting style (PS)	(<i>d</i> = 0.77)	1.2/3 significant (<i>d</i> = 0.82) 2. 0/3 significant (<i>d</i> = 0.39)	2. 2/3 Improved to follow-up

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Table1 Footnotes.

AADQ = Acceptance and Action Diabetes Questionnaire; AAQ II = Acceptance and Avoidance Questionnaire II; ASA-24 = Automated Self-Administered 24-hr Dietary Recall; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; BDI II = Beck Depression Inventory II; BMI = Body Mass Index; BSI-18 = Brief Symptom Inventory (18 item); CCVFFQ = Cancer Council Victoria Food Frequency Questionnaire; CECS = Courtland Emotional Control Scale; COPE = The COPE Questionnaire; DASS = Depression Anxiety and Stress Scale; DCP = Diabetes Care Profile; DSCAM = Diabetes Self Care Assessment Measure; DT = Distress Thermometer; ECBI = Eyberg Child Behavior Inventory; FAAQ = Food Acceptance and Action Questionnaire; FACITFS = Functional Assessment of Chronic Illness Therapy Fatigue Scale; FACIT-Sp = Functional Assessment of Chronic Illness Spiritual Well-being; FACT = Functional Assessment of Cancer Therapy; GLTEQ = Godin Leisure-Time Exercise Questionnaire; HADS = Hospital Anxiety and Depression Questionnaire; IPAQ = International Physical Activity Questionnaire; MAAS = Mindfulness Attention Awareness Scale; PA-AAQ = Physical Activity Acceptance and Action Questionnaire; PCL-C = PTSD Checklist-Civilian Version; PECI = Parent Experience of Child Illness; PGI = Post-traumatic Growth Inventory; PHLMS = Philadelphia Mindfulness Scale; POMRF = Psychotherapy Outcome Study Methodology Rating Form; POMS = Profile of Mood States; PPF = Parental Psychological Flexibility Questionnaire; SDQ = Strengths and Difficulties Questionnaire; SF-36 = Short-Form 36; SI = Seizure Index; SWLS = Satisfaction With Life Scale; VGCM = Values and Goals Clarity Measure; WBSI = White Bear Suppression Inventory; WHOQOL-BREF = World Health Organisation Quality of Life

*Large number of outcome variables; only those which appeared to be primary and secondary outcomes reported (post-traumatic growth, spirituality and fatigue excluded)

HIGHLIGHTS

1. A growing body of work – eighteen intervention studies, of which eight are randomised controlled trials – has assessed the utility of ACT for a range of outcomes in long-term conditions.

2. To date study quality is generally low. As ACT appears to be used clinically, higher-quality RCTs are now needed to accurately characterise its effects.

3. Nonetheless, data derived from higher-quality studies suggest promising effects for certain applications: parenting of children with long-term conditions, seizure-control in epilepsy, psychological flexibility and possibly disease self-management.